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FITZPATRICK CELLA HARPER & SCINTO
30 ROCKEFELLER PLAZA
NEW YORK, NY 10112

EXAMINER	
QIN, YIXING	
ART UNIT	**PAPER NUMBER**
2622	

DATE MAILED: 09/08/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/859,437	ILBERY ET AL.	
	Examiner	Art Unit	
	Yixing Qin	2622	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *19 May 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-10 and 12-33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) *13* is/are allowed.

6)☐ Claim(s) *1-10,12,14-21 and 23-33* is/are rejected.

7)☐ Claim(s) *8 and 22* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *19 May 2005* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *8/2/01, 6/6/02*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

In response to applicant's amendment received 5/19/05, all requested changes have been entered.

Response to Arguments

Claim 13 has been amended and the Examiner agrees that Hines does not show all of the limitation of claim 13. Furthermore, the Examiner has deemed that claim 13 is allowable since no prior art of record can be found to teach all of the limitation of claim 13. Claims 8 and 22 are being object to because no prior art of record discloses the limitation in these two claims. Please see below for reasons for allowance.

After considering the arguments, the Examiner acknowledges that Hickman does not necessarily disclose the biasing of the image value from one nozzle to another nor does it teach the newly amended claims that include halftoning. However, a new reference, Billet (U. S. Patent No. 6,010,205), teaches and/or suggests the compensation of a defective nozzle by printing with a working nozzle in its place (see abstract) and the previously presented Yen reference was used to teach halftoning. The Examiner does agree that Suzuki by itself does not teach and or suggest all aspects of the invention. However, it was used to simply teach certain limitations that were missing from Hines, Semasa and/or Yen as a secondary or tertiary reference. The Examiner has also brought in three new references to teach and or suggest (maybe in combination with the previously presented references) the claims that are not allowed or objected.

Allowable Subject Matter

Claims 8 and 22 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim 13 is allowed.

The following is an examiner's statement of reasons for allowance: Claims 8 and 22 are directed to having the ability to redistribute image values that is dependent upon an initial residual image value (i.e. image value left over that still needs to be distributed), and doing such with an ink of a different color. The ability to compensate with an ink of a different color is known (i.e. see lines 16-21 of the abstract of Murcia et al – U.S. Patent No. 6,270,187), but no prior art of record teaches that there is the redistribution dependent upon a residual value.

Claim 13 is allow because no prior art of record teaches the use of an error diffusion table that uses a relationship between image values and average nozzle firing values dependent upon the printing desirability factors of nozzles in a print head.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

I. Claims 1-5, 14-17, 21, 30, 32, and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Billet (U.S. Patent No. 6,010,205) in view of Yen et al (U.S. Patent No. 5,992,962 – "Yen").

1. **Claim 1**
   - Billet discloses in column 5, lines 51-59 that the 95th nozzle is malfunctioning and that a line was not produced. (i.e. **first image value** is non-existent, or "0"). Although not explicitly stated, the **printing desirability factor** is not explicitly disclosed, one skilled in the art would know that the desirability of a malfunctioning nozzle is low or none.
   - Billet further discloses in column 6, lines 27-42 that a properly functioning nozzle can be used to compensate for malfunctioning nozzles (i.e. create a **second image value**). One would understand that this act of compensation (i.e. **biasing**) is based on the fact that no ink was deposited by the malfunctioning nozzle (i.e. **first image value** is non-existent, or "0") and that the malfunctioning nozzle is not desirable to be used since it cannot drop ink (i.e. **printing desirability factor**) – see column 6, lines 10-15.
   - Billet does not explicitly disclose any techniques associated with halftoning. The secondary reference, Yen et al, discloses in column 4, lines 34-38, that their invention uses "...a unique print mask that...uses nozzles along the outer edges of the black print head to print in place of defective interior nozzles, while applying such techniques as halftoning techniques to smooth the transition from each printing pass." Furthermore, in column 5, lines 32-33, Yen et al discloses that "[t]he mask herein described is implemented in the control signals applied to the print head," and in column 6, lines 38-39 that "[in their] invention, a halftone-like pattern is applied to the print mask."
   - It would be obvious that the **nozzle firing value** would be 100% of the **first image value** because the malfunctioning nozzle is not used to drop any ink at all.
   - Billet discloses the printing of the image value in column 6, lines 38-42.
   - Both references are in the art of printing and image correction, it would be obvious to one of ordinary skill in the art at the time of the invention to apply a halftoning technique to Billet's invention. The motivation would be to provide further image smoothing and unevenness-correction before the printing process has begun.

2. **Claim 2**
   - As mentioned above, it would be obvious that the desirability of a nozzle would be of the effectiveness/defectiveness (i.e. if the nozzle is malfunctioning).

3. **Claim 3**
   - Although Billet does not go into detail about the proximity of the nozzles to compensate for the malfunctioning nozzle, but does disclose in column 2, lines 36-41 that the print heads (which contain the nozzles) of the same color are grouped together. Therefore, it would be obvious to one of ordinary skill to use neighboring or at least close by nozzles to print the same color.

4. **Claim 4**
   - As mentioned above all of the first image value would be redistributed to a second nozzle since the malfunctioning nozzle in Billet is not activated. Also see, for example, column 8, lines 56-61.

5. **Claim 5**
   - As discussed above, when nozzle does not put out any ink, it can read on 0%, and also a nozzle can compensate for 100% of the malfunctioning nozzle's output, i.e. outputs 100% image value.

6. **Claims 14-17**
   - The first, second, and last limitations of these claims are the same and will be addressed first.
   - The image forming elements in Billet's invention are the nozzles and one knows that recording signals are needed in order to drive the nozzles to form an image.
   - Billet discloses in column 6, lines 10-14 that malfunctioning nozzle information can be stored. Note such information in Figs. 5A-5C of Billet.
   - The last limitation was addressed in claim 1 above, that Billet does not explicitly disclose any techniques associated with halftoning. The secondary reference, Yen et al, discloses in column 4, lines 34-38, that their invention uses "...a unique print mask that...uses nozzles along the outer edges of the black print head to print in place of defective interior nozzles, while applying such techniques as halftoning techniques to smooth the transition from each printing pass." Furthermore, in column 5, lines 32-33, Yen et al discloses that "[t]he mask herein described is implemented in the control signals applied to the print head," and in column 6, lines 38-39 that "[in their] invention, a halftone-like pattern is applied to the print mask."
   - For **Claim 14**, the difference in the third limitation is the biasing is based on the relative desirability factor of other forming elements. Although not explicitly stated, the **printing desirability factor** is not explicitly disclosed, one skilled in the art would know that the desirability of a malfunctioning nozzle is low or none and the desirability for functional nozzle (i.e. ones used to compensate) would be high. Billet discloses in column 6, lines 27-42 how different nozzles can compensate for malfunction ones in subsequent scan, because the malfunctioning nozzles have been identified. The **image value** formed by the defective nozzle would be 0, and the use of a subsequent nozzle to make up for this is dependent upon the fact that, obviously, the malfunctioning nozzle has no printing desirability.
   - For **Claim 15**, the difference in the third limitation is the biasing is based on the relative desirability factor of other forming elements and the image values for those other forming elements. The desirability has been addressed above. As for the image values of the other elements, in the regular mode, the image values would be 100% for the functional forming elements, so the biasing would be that the entire image value of the malfunctioning nozzle would be made up by the

compensation nozzle. Billet also discloses in column 6, lines 43-67 an example of the 50% overlap mode.

- For **Claim 16**, the difference in the third limitation is forming of redistributed image values. Although not explicitly disclosed by Billet, one would understand that the redistributed image values would be the entire image value that should have been printed by the malfunctioning nozzle since another nozzle is to make up for the entirety of the malfunctioning nozzle's ink (as disclosed above).
- For **Claim 17**, it is similar to claim 16 combined with the fact that the use of a particular forming element is based on desirability. These two aspects have been addressed in claim 14 and claim 16 above.

7. Claim 18

- As disclosed in the rejection to claim 16 above, the nozzle compensation technique is simply an ejection of a similar dot by another nozzle to compensate for the failure of a previous nozzle to eject a dot. It would make sense that the nozzles be uniform in nature and that the amount of ink in ejected by the working nozzle would be the same as the defective nozzle (i.e. not eject more ink than needed).

8. Claim 19

- Billet discloses in column 2, lines 36-42, CMYK printheads.

9. Claim 21

- From Claim 19 above, the invention of Billet is a color printer with different colored print heads.

10. Claim 30

- Billet suggests in column 6, lines 27-31 that the malfunctioning nozzles are prevented from recording because their desirability is low (because they are not working properly).

11. Claim 32

- The use of film boiling is a well-known technique in inkjet printing.

12. Claim 33

- Billet discloses in column 3, lines 1-27 the printing of bands on a sheet of paper. Although multiple passes are disclosed, the use of a single pass would be obvious.

II. Claims 6,9,12, and 23-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Billet (U.S. Patent No. 6,010,205) in view of Yen et al (U.S. Patent

No. 5,992,962 – "Yen") and further in view of Suzuki et al (U.S. Patent No. 6,036,300 – "Suzuki).

13. Claim 6

- From claim 5 above, one can see how 100% intensity is achieved. However, no mention was made about going over that value. The Suzuki et al reference also disclosed the idea of using other nozzles) to compensate for defective nozzles as well. In addition, in column 18, lines 18-27, Suzuki et al discloses that "...the maximum recording density becomes 1 .5 when the maximum value of the image data is FFH." Although 1.5 is an indication of 150%, it is clear that one can simply increase this amount by setting a threshold at a higher value (i.e. 2 or 200%).
- Since all three references are in the art of printing and image correction, it would be obvious to one of ordinary skill in the art at the time of invention to allow Billet's invention to have nozzles that print at above 100% intensity. The motivation would be to have more image evenness since printing 200% intensity dots from one nozzle could is effectively the same as printing two 100% intensity dots from different nozzles.

14. Claim 9

- The goal of the mapping process is to reduce the complexity in the unevenness correction process as stated in line 22 of page 18 of the specification.
- The Suzuki reference discloses in column 18, lines 58-62 that " the imaqe data is multiplied by 1/1 .1 (=0.91) (because the density of the printed dot is 10% too dense as explained in column 18, lines 38-57)...[and] the image density to be recorded by the Y position 412 of the recording head 401 can be equalized to the estimated density." Of course, if the density is assumed to be much higher (say at 200%) then one can multiply the density by % to reach 100%. This multiplication of a factor effectively rescales the amount of depositing of ink to a density level that is closer to the one specified in the image data.

15. Claim 12

- The Hickman reference fails to disclose an adjustment mechanism between an input and an output value. The Suzuki reference discloses in Fig. 24 and column 19, lines 6-12 that the process explained in the previous paragraphs (column 18, lines 58-67, and column 19, lines 1-5 of Suzuki et al) of density adjustment is controlled by gamma control units. Although Suzuki et al does disclose the relationship of an input value to an output value as well as the idea of super-intensity printing (i.e. having a maximum density of 1.5, column 18, line 26), it does not disclose halftoning. Neither reference discloses anything about halftoning. However, the tertiary reference, Yen et al, discloses the idea of halftoning.

- The Yen et al reference discloses in column 4, lines 34-38, that their invention uses "...a unique print mask that...uses nozzles along the outer edges of the black print head to print in place of defective interior nozzles, while applying such techniques as halftoning techniques to smooth the transition from each printing pass." Furthermore, in column 5, lines 32-33, Yen et al discloses that "[t]he mask herein described is implemented in the control signals applied to the print head," and in column 6, lines 38-39 that "[in their] invention, a halftone-like pattern is applied to the print mask."

16. Claim 23

- Suzuki et al discloses in column 18, lines 18-33 the comparison of the density of an actual recorded dot to that of the recording (image) data. Furthermore, in column 18, lines 44-47, Suzuki et al discloses an example explain that "[t]he recording is performed at a density which is higher than the estimated density by 10%." This is an indication that a nozzle can print at a higher density than what is needed to be recorded.
- Suzuki discloses in column 18, lines 53-58, that "...if the recording is performed each by the Y portion 412 and Z portion 412 of the recording head 401 without any correction, the recorded density is higher than the estimated density by 10% as in the case of the recording in the X portion 411."

- From previous rejections, it was known that there would be compensation for defective nozzles by printing dots from another nozzle. Both nozzles could be printing in the same portion and would both be printing 10% more density.

17. Claim 24

- Suzuki et al discloses in column 18, lines 23-27 that "[the] recording density is estimated as 0.75 in a case of a printing apparatus where the maximum recording density becomes 1.5 when the maximum value of the image data is FFH, for example." This indicates that the nozzles of Suzuki et al's reference are able to print a variable range depending on the density of the image to be printed.

18. Claim 25

- Suzuki et al discloses in column 18,lines 58-67 and column 19, lines 1-4, processing for averaging densities of X, Y, and Z printed portions so that the average density of the area printed is the same as the recording or image data. From the rejection to claim 23 above, Suzuki et al pointed out that the various portions printed different densities. The multiplication by a factor of 0.91 (column 18, line 59) to the portions with the increased densities brings the density of the printed area down. Thus the average over the entire area having X, Y and Z portions is the same as the image data.

19. Claim 26

- This method of averaging is discussed in the rejection to claim 25 above. The X, Y and Z portions have differing densities, but the average for the image region is still "1." (Suzuki et al, column 19, lines 1-4)

III. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Billet (U.S. Patent No. 6,010,205) in view of Yen et al (U.S. Patent No. 5,992,962 – "Yen") and further in view of Hickman (U.S. Patent No. 4,963,882).

20. Claim 7

- The Hickman reference discloses in column 3, lines 59-62 that "[d]ots of secondary colors are formed by overprinting two dots of primary colors, wherein each dot is printed using two or more droplets of each primary color, each droplet being from a different nozzle." This means that a dot of a secondary color has a total of at least four nozzles associated with it (two drops from two different nozzles of a first primary color plus two drops from two nozzles of a second primary color).

IV. Claims 10, 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Billet (U.S. Patent No. 6,010,205) in view of Yen et al (U.S. Patent No. 5,992,962 – "Yen") and further in view of Suzuki et al (U.S. Patent No. 6,036,300 – "Suzuki) and further in view of Semasa (U.S. Patent No. 5,418,626).

21. Claim 10

- The first three references do not go into detail about checkerboard quantization.
- The Semasa reference discloses a quantizer (item 4 of Fig. 5) and in Fig. 6b shows a % image of an image after having been quantized. In column 3, lines 26-27, the description shows that figure 6b is a black and white checkerboard test pattern of an original image. Furthermore, in column 5, lines 39-45, Semasa discloses that "[in] FIG. 1 , an image signal memory 1 temporarily stores the input image signal S1. An enlargement/reduction calculator circuit 2, coupled to the image signal memory 1 to receive the output S2 thereof, effects a weighting calculation at a 8-bit precision in accordance with the magnification rate (enlargement/reduction factor)." Furthermore, Semasa discloses in column 4, lines 63-67 and column 5, lines 1-5, that their invention has a "...quantizer 4 [that] quantizes the compensated grey level Cxy...by thresholding, for example, at W. and thereby obtains the output image signal 55 representing the quantized binary level Oxy...land that the) binary level 0> is determined by :

  $O_{xy} = 1$ where $C_{xy} \geq ½$ and
  $O_{xy} = 1$ where $C_{xy} < ½$

- This method of rounding up and down by Semasa is to allow 8-bit representation of numbers without having to deal with decimal places.
- Since all references are in the art of image processing and error correction, it would be obvious to one of ordinary skill in the art at the time of the invention to improve Billet's invention with the quantizing technique as disclosed by Semasa. The motivation would be to provide a method for the representation of decimal values without decimal places using eight binary digits and maintaining a constant density over an area.

22. Claim 27

- Since the Suzuki et al reference has the ability to multiply the density of the image data to be recorded for the various X, Y and Z portions, they could simply use factors of 0.5 and 2 for alternating regions in order to accomplish the same

job as being done according to claim 27. Furthermore, the Semasa reference discloses a quantizing method using rounding (see rejection to claim 10 above).

23. Claim 28

- The Suzuki et al reference discloses that there are signals associated with the operation of the nozzles as mentioned in the claim 14 rejection above and super intensity recording as mentioned in the claim 23 rejection above. However, the Suzuki et al reference does not explicitly disclose that the means that generates these signals is halftone in nature.
- The Semasa reference discloses halftoning, but does not explicitly disclose that they have some parameters that control or adjust the frequency of super-intensity printing.

  The Yen et al reference discloses in column 4, lines 34-38, that their invention uses "...a unique print mask that...uses nozzles along the outer edges of the black print head to print in place of defective interior nozzles, while applying such techniques as halftoning techniques to smooth the transition from each printing pass." Furthermore, in column 5, lines 32-33, Yen et al discloses that "[t]he mask herein described is implemented in the control signals applied to the print head," and in column 6, lines 38-39 that "[in their] invention, a halftone-like pattern is applied to the print mask."

V. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Billet (U.S. Patent No. 6,010,205) in view of Yen et al (U.S. Patent No. 5,992,962 – "Yen") and further in view of Murcia et al (U.S. Patent No. 6,270,187 – "Murcia").

24. Claim 20

- Neither Billet nor Yen explicitly discloses the desirability of forming elements of other colors. However, the tertiary reference, Murcia discloses in lines 16-21 of the abstract of Murcia et al and column 9, lines 21-31, that a combination of colors could be used to compensate for a failed black nozzle. Since the nozzles of another color are not defective, the desirability of the nozzles of another color is high, and one would based a decision to use those non-defective nozzles based on this desirability.

VI. Claim 29 is rejected under 35 U.S.C. 103(a) as being unpatentable over Billet (U.S. Patent No. 6,010,205) in view of Yen et al (U.S. Patent No. 5,992,962 – "Yen") in

view of Suzuki et al (U.S. Patent No. 6,036,300 – "Suzuki) in view of Semasa (U.S. Patent No. 5,418,626) and further in view of Hines (U.S. Patent No. 6,034,782).

25. Claim 29

- The first four references show all parts of the limitation except the use of an error diffusion table. Hines discloses in Fig. 2 and column 3, lines 33-37 that Fig. 2 shows "...a flow chart of...a cable test routine in an inkjet printer which uses a downloaded error diffusion table to convert a multi image to a half-tone image."

VII. Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Billet (U.S. Patent No. 6,010,205) in view of Yen et al (U.S. Patent No. 5,992,962 – "Yen") and further in view of Ichikawa et al (U.S. Patent No. 5,038,208).

26. Claim 31

- Neither Billet nor Yen goes into detail about the density. However, the tertiary reference, Ichikawa, discloses in column 1, lines 47-54 the storage of non-uniformity of the density of an image and having a corrector means for correcting the image forming signals based on the corrector means.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yixing Qin whose telephone number is (571)272-7381. The examiner can normally be reached on M-F 9:30-6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Coles can be reached on (571)272-7402. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

YQ

EDWARD COLES
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600